

---

Multifunctional pushbutton switch

---

The invention relates to a multifunctional pushbutton switch with several pushbutton switching units whose pushbutton surfaces are close to each other in a shared operating surface, especially for a vehicle steering wheel, with a shared 5 switch housing in which the actuation tappets of the pushbutton switching units are configured so that they can move.

With multifunctional pushbutton switches, especially in multifunction steering wheels for vehicles, the individual pushbutton switches are grouped next to each other and they project individually from openings of a cover. As a result, they can 10 be felt and operated without visual contact. The assembly of such a multifunctional pushbutton switch, however, is highly complex.

The invention provides a multifunctional pushbutton switch that can be visually and functionally well integrated into an existing environment, especially into the steering wheel of a vehicle. The multifunctional pushbutton switch according 15 to the invention has a cap that is made by means of a two-component injection-molding technique and that is mounted onto the actuation tappets and onto the switch housing. The cap consists of a relatively rigid plastic frame with cutout windows whose shape and size each correspond to the circumference of one of the pushbutton surfaces and consists of a silicone membrane stretched over the windows. In this manner, the multifunctional pushbutton switch has a completely 20 contiguous operating surface that is formed by the outer surface of the silicone membrane. The actuation tappets of the pushbutton switching units can be felt through the silicone membrane and can be actuated by pressure exerted on the outer surface of the silicone membrane. The silicone membrane preferably 25 extends continuously over the entire outer surface of the cap, which is integrated into the surface of the steering wheel body.

In the case of multifunctional pushbutton switches whose individual pushbutton surfaces lie closely adjacent to each other, the possibility exists that several pushbuttons might be actuated at the same time. This can be prevented if, according to an embodiment of the invention, the individual pushbutton surfaces 5 of the pushbutton switching units are delineated by a star-shaped or cross-shaped support structure that is formed in one piece with the plastic frame. The actuation tappets are preferably pressed resiliently against the inner surface of the silicone membrane, but are retained by stop members in their unactuated resting positions. These stop members are formed by lateral projections that are molded onto the 10 actuation tappets and that interact with the surface of the support structure that faces away from the silicone membrane and that is covered with a layer of silicone material. The multifunctional pushbutton switch preferably has an altogether convex operating surface.

Additional features and advantages of the invention ensue from the following 15 description of a preferred embodiment and from the drawing to which reference is made. The drawing shows the following:

- Figure 1 a perspective view of a cap;
- Figure 2 a top view of the inside of a cap;
- Figure 3 a sectional view of a multifunctional pushbutton switch;
- 20 - Figure 3a a detailed view from Figure 3; and
- Figure 4 a sectional view of the cap of the multifunctional pushbutton switch.

The cap of a multifunctional pushbutton switch generally designated with the reference numeral 10 in Figures 1 and 2 has a frame 12 made of relatively rigid plastic from which windows 14 are cut out, over which a silicone membrane 16 is 25 stretched. The silicone membrane 16 forms a completely contiguous operating surface on the outer surface of the cap. The windows 14 are delineated from each other by a cross-shaped support structure 17 that is formed in one piece with the

plastic frame 12. Moreover, fastening domes 19 are shaped onto the plastic frame 12.

Figure 3 shows a switch housing 20 onto which the cap 10 has been placed. A baseplate 21 that has a switching mat 22 on a printed circuit board 23 is inserted 5 into the switch housing 20. The switching mat 22 has shaped-in domes with contact tabs as movable contacts 24, 26 that are each actuated by an actuation tappet 28 or 30. Of the total of four actuation tappets of the multifunctional pushbutton switch, only the actuation tappets 28 and 30 can be seen in Figure 2. The actuation tappets 28, 30 are pressed from the inside against the silicone membrane 16, giving 10 it a convex curvature. On its actuation surface lying against the inner surface of the silicone membrane 16, two of the total of four actuation tappets 28, 30 have a concave form that can be felt through the membrane. The other two actuation surfaces can be convex.

The actuation tappets 28, 30 are provided with lateral projections 32 that project underneath the support structure 17 and that come to rest against the underside of the support structure 17 that is covered with a layer of silicone material, as long as the appertaining actuation tappet is not actuated. The stop noise is muffled 15 by the silicone material.

The cap 10 consisting of the frame 12 and of the silicone membrane 16 is configured as a two-component injection-molded part. The outer surface of the frame 20 12 is completely covered by a continuous layer of silicone material. Between the material of the frame 12 and the layer of silicone material, there is a bonded connection that can be mechanically stressed and that is splash-proof. Since the layer 25 of silicone material surrounds the frame 12 on its outer circumference, there is also a positive connection that further increases the mechanical stressability. Moreover, this creates not only a completely contiguous operating surface over the actuation tappets, but also a visually attractive appearance. If the operating 30 surface is to be labeled, for example, with symbols indicating the function of the individual pushbutton switches, then a high positional accuracy is ensured since the rigid frame 12 cannot shift with respect to the silicone layer that covers it. In

this case, the operating surface is preferably provided in symbol color and then coated in a dark color; the symbols are cut out from the dark coating layer by means of a laser beam.